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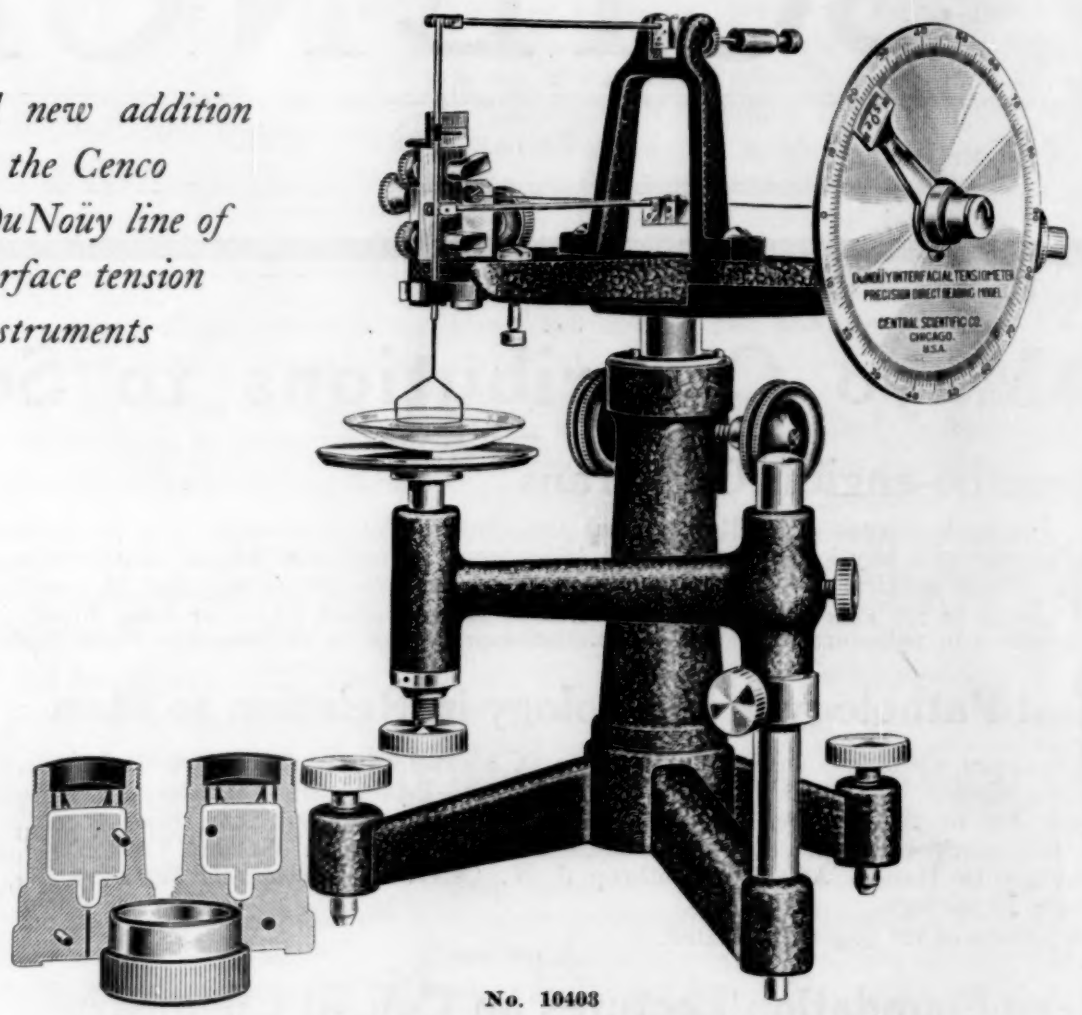

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THE TWENTY-FIFTH ANNIVERSARY OF INITIATION OF RESEARCH IN THE CARNEGIE INSTITUTION OF WASHINGTON[1]

THE founding of the Carnegie Institution of Washington was of peculiar significance as an influence turning attention toward advancement of knowledge, as contrasted with its restatement or transmission. The establishing of an agency for this specific purpose did not indicate that such activities were considered either more or less important than educational work. It presented rather a coordinate or supplementary program, which would naturally gear itself closely to that of institutions designed initially for the work of education, or for other special applications of knowledge.

A group of the principal departments originated in 1904. Among them were Terrestrial Magnetism, Mount Wilson Observatory and Experimental Evolution. The last of these formed the basis for development of the present department of genetics. In the history of the institution many types of organization have been used, and there have been numerous changes in statement of program. So the contribution of Mrs. Harriman, through gift of the Eugenics Record Office with its generous endowment, led in 1921 to union of eugenics and experimental evolution in the Department of Genetics.

In somewhat similar manner the Division of Plant Biology, established in 1928, shaped itself to embrace the work of six sections, including physiology of growth, photosynthesis or the utilization of solar energy by the plant, classification and its relation to heredity and environment, studies on the influence of aridity, the section concerned with relationships to environment, and one devoted to the history of plants.

Development of the institution illustrates what have seemed to be the needs of organization in attempting to secure the largest measure of return in investigation. Recognition of research as in itself an essential human activity had not attained the wide acceptance of the present decade, and much of the effort of the institution was given to support of investigation wherever opportunity might be found. The interest of Mr. Carnegie in discovery of genius or the exceptional man found expression in numerous spe-

[1] Addresses given at Cold Spring Harbor, May 31, 1929, Dr. Henry S. Pritchett, vice-president of the board of trustees, presiding.

cial grants, designed generally for personal work in specified fields.

With continuing study of opportunities for constructive work it was apparent that, in addition to the discovery of genius, advance of knowledge depends in some measure upon the possibility of bringing into research a degree of cooperation comparable to that which has been broadly characteristic of human relations in the advance of civilization. Out of this idea arose a type of department making possible concentration of effort upon a major problem, and opening the way also to effective advance of genius working in relation to other coordinate interests.

From the earlier trend of the institution toward extreme, and sometimes isolated specialization, the more fully appreciated unity of knowledge in present-day thinking has brought once more a recognition of the interdependence of all scientific groups. Cooperative researches, including the most widely separated departments and investigators, have developed a unity of interest and operation within the institution. They have brought into close relationship many elements which seemed only remotely related in objectives, and were widely separated geographically. In general the community of interest developed is at least as intimate as that which obtains within the spatially narrow limits of a campus. So we see the geophysicist and astronomer make plans for joint spectroscopic study of gases flaming from the inner earth; we find the physicist, chemist and astronomer turning their concentrated interest upon the crucible of the sunspot or the spectra of remote nebulae; in biology the physicist and geneticist unite to wrest the secrets from the chromosome; in another region the plant physiologist, the mathematical astronomer, the paleobotanist, the archeologist, and the meteorologist enter together upon study of varying patterns in the rings of a fossil tree, in order to learn the habits of the sun in radiation of its energy in a remote geological period.

To-day we find the institution utilizing all the major types of activity that have arisen in the quarter century experiment of its organization. There are still widely ranging special grants. Great departmental activities still represent concentrated effort in specific fields. The increasing mutual interest among research groups has not diminished the initiative of the individual. With the passing of time the element of broader cooperation within the institution has made more effective both the special concentration on particular projects and the development of that wider view so essential in long-continued research operations.

As the institution developed and research production attained considerable volume, it became clear that one of the greatest responsibilities relates to the making of results available for others. Whether this concern the investigator, the general student, or the intelligent citizen, there is increasing realization that if the treasures obtained are hidden in labyrinths bounded by unmeasured walls of printed pages, they may bring relatively small contribution to the community which makes possible the joy of this work.

In activities concerned with the field of the unknown, it will always be difficult to devise arrangements by which the information secured can be disseminated directly to those for whom they have largest use. But it is at least true that in the work of the institution, each year sees real increase in effectiveness of statement, interpretation and distribution of materials. This applies not only to means used in reaching other specialists of the same field. It concerns as well the extremely important opportunity for communicating the results to students of related subjects, as also to the engineer or applier of knowledge, and to those with interest in knowledge for its own sake.

There has not appeared in these developments a tendency to direct institution activities into the field of education as it is generally known. There *is* expressed the recognition of a responsibility for transmitting information regarding researches in progress in such manner as to attain as nearly as possible full value for the work as it proceeds.

The exhibits presented here to-day for the inspection of our friends illustrate one aspect of our view with relation to interpretation of research. They are the materials used in significant investigations now under way, and are planned to make a simple statement of the problems attacked. They are naturally in the main obtained from the laboratory at which we meet. They have special value because of the opportunity to see them through the eyes of those who have conducted the investigations. In addition to indicating the character of the questions asked of nature they show the mode of approach in attempting to obtain answers. If the story could always be told as effectively as it is developed here, we should have advanced far in bringing research to a point at which the statement of its results would be at once an extremely effective form of education.

Concrete illustrations of the tendency to relationship among investigating groups of the institution are furnished through several groups of exhibits. In the first building there is illustrated a research on the development of the mouse, and the influences which may affect these changes. It is interesting to note that the early growth stages, showing division of the mouse egg into complex cell-structure, have been furnished by cooperation with our department of embryology in Baltimore.

In the second building the exhibit, expressing the extremely important relation between the thyroid glands and the process of metabolism or energy production, is a joint investigation carried on by Dr. Riddle, of the department of genetics, and Dr. Benedict, of the department of nutrition in Boston. It contributes on the one hand to interpretation of metabolism, and, on the other, concerns that extremely important influence of the endocrine glands which plays so large a part in the later stages of development. By way of the department of nutrition, this investigation has also close relationship to still other researches in the field of nutrition which are conducted under support of this institution by a distinguished group of investigators led by Dr. Mendel at Yale University.

The exhibit by Dr. Blakeslee, in the first or main building, representing through use of the jimson-weed one of the outstanding studies of the mechanism of heredity and mode of development in plants has its intimate relation to much of the research furthered by the institution's division of plant biology. Especially closely does it touch the genetical researches of Dr. Belling, of that group, and the cooperative investigations of Dr. Babcock in the University of California.

The exhibit of Dr. Banta, in the first building, illustrating influence of various external conditions upon sex and other features in development, is one of the outstanding studies concerning relation between hereditary tendencies and environmental influences. Another institution research of comparable type is that of Dr. Clements, of our division of plant biology. Dr. Banta's investigations are limited to study of a small group of organisms, water fleas, examined by a wide variety of methods, and over a long period. The studies of Dr. Clements concern more especially the relationships of great masses of individuals in relation to their environment under conditions as they are found in nature.

In the Eugenics Record Office on the hill above us, Dr. Laughlin's unique genetical researches in inheritance of physical and psychological characters of the thoroughbred horse make direct contribution toward the study of inheritance of physical and mental characteristics in man.

But the background against which these interesting accumulations of experience in observation of the horse must be projected, is formed by such researches as those on the fruit fly under the hand of Morgan, Metz and many others, on the larkspur as examined by Demerec, on the study of variation in maize, on the chromosomes of the jimson-weed, and through a whole new world of knowledge developing in many institutions engaged in research.

The special studies on human inheritance and development, constituting Dr. Davenport's culminating problem of the Eugenics Record Office, depend not only upon the broad foundation of researches extending from genetics through all biological and physical sciences, but connect us in other directions with a great field of inquiry on specifically human questions, presumably not to be solved solely by study of plants or lower animals.

One of the interesting illustrations showing relationship of this work to that of another institutional activity is found in the cooperation between genetics and early American history in a study of race mixture. On the biological side there are involved the elements of inheritance through the chromosome, and the influence of the ductless glands upon development. The biological researches lead into investigations of mental traits and the consideration of human thinking and emotion, in which science has done little more than to lay out a region where it expects to make progress by the scientific method.

On the historical side of the work we see another group of students slowly but surely bringing together the kaleidoscopic picture of human experience. Essentially it seems an expression of the potentiality of man in nature with respect to change in accordance with law.

While genealogy, as sometimes interpreted, appears to look to the past as a justification for what exists, history tends to see its much longer record not merely as justifying what is, but as the evidence of a great becoming.

History would admit the absence of value in consideration of a past from which there comes no lesson, or of things for which there is no remedy. It is good philosophy, as well as good psychology, to turn away from that which can not be corrected. It is also true that, taking human experience in the large, the joy of living and of being will not depend alone upon the manner in which what lies before us functions at a given moment. Two of the greatest truths in science concern, on the one hand, the unity of nature in the operation of its laws, and, on the other, the evidence that what we call stability of form or function is found only by those who see the universe, or any part of it, as an illumination of experience corresponding to the vision of a wind-swept forest under a lightning flash.

With what we know of nature and of man, it might appear that one who learns to know not only the form and functions at a given moment, but sees also the controlling modes of change, might well become master in the universe.

And finally, as wide as may be the range of these researches and the relationships which I have attempted to sketch—chromosome, mouse, thyroid of dove, horse, man—we find them balanced against each other as complementary elements in method and

in point of view. It is through this kind of breadth of vision and mutual support that combined efforts of the many and varied institutions, such as are represented here to-day, may hope ultimately to obtain a clear and verifiable picture of the world about us, and of the place which man has in it.

JOHN C. MERRIAM,
President

ANNIVERSARIES like this are occasions of retrospect as well as of prospect. The marvelous progress in all fields of science during the past twenty-five years is probably greater than in any other century in the world's history. In large part this is the result of the general recognition of the importance of research and the munificent support which it has received during the past quarter century. The research spirit has been present in man from time immemorial; indeed it is as old as the race of thinking men. It is mentioned in the book of Proverbs where it is said: "It is the glory of God to conceal a thing, but the honor of kings is to search out a matter." But until recently opportunities for detailed, minute and continuous researches have been very limited.

Many colleges and universities that are now important centers of research made little provision for it twenty-five years ago. They were glad to say that their professors were conducting original work since this was good advertising, but those professors in general conducted their studies in the tag ends of their time and largely at their own expense. Most of us remember how professors used to talk about their research as "my own work," whereas teaching and administration was the university's work. It is only within recent times that this has changed and universities in this country have come to recognize that research is as important a part of the work of a university as teaching, and that both must go forward together in order that education and information may properly advance.

The Smithsonian Institution, founded in 1846, was probably one of the first institutions in America that was organized for the purpose expressed in the fine words of its founder, "For the increase and diffusion of knowledge among men." Other institutions more or less concerned with research were the learned societies, academies and museums. But they also had other functions and research as we now understand it was a relatively minor part of their programs. But at the end of the last century and the beginning of the present one there came a great impetus for research work for its own sake, and at this auspicious time the Carnegie Institution of Washington was established.

During the past twenty-five years research institutions and opportunities have multiplied abundantly, and they have introduced what may truly be described as a new era in human history. There is now universal recognition of the importance of research, not only for the increase of knowledge for its own sake, but also for the preservation and promotion of national welfare. This spirit of the new age puts upon those who are engaged in research and upon its promotion a tremendous responsibility. We have educated the public to recognize the supreme importance of scientific investigation; it remains to be seen whether we can convince the public that all the effort and expenditure which has gone into such study is justified. When I read in the newspapers some of the lurid representations of what has been accomplished by research, and more particularly of what we may expect in the near future, I confess to the feeling that there is bound to be some disappointment when these extravagant expectations fail to be realized; when the public is informed, as it sometimes is, that scientists have reached the conclusion of the whole matter, that their knowledge is fixed and final, I know that they are being misled, for the scientist knows, better than any other perhaps, that his knowledge is tentative and that he never reaches the goal toward which he travels. Like the El Dorado of the early conquistadors that goal ever lies beyond the next range of mountains. But to the real scientist this is a challenge rather than a discouragement, for, as Robert Louis Stevenson so beautifully said, "To travel hopefully is a better thing than to arrive, and the true success is to labor." Science travels hopefully and will continue to do so as long as civilization survives.

A retrospect over the field of biology shows three great eras past and one in progress at the present time, though, of course, these eras are not sharply divided and there is a large amount of overlapping: First of all, there was the era of exploration and of classification, and during this period emphasis was placed on the differences that exist among species, phyla, kingdoms. Botany, zoology and physiology were treated as distinct and independent sciences.

Then came the era of comparison, of comparative anatomy, embryology and physiology. During this period emphasis was placed on homologies and resemblances rather than differences. Morphology and physiology still remained as independent sciences, but botany and zoology were seen to have very much in common.

The third era of biological progress was one of generalization and speculation regarding evolution, heredity and variation. It was characterized by the marshalling of known facts regarding these subjects

by Darwin (1859), Galton (1869), Weismann (1885). Speculation regarding these subjects flourished mightily. Phylogenetic trees for every group of the animal and plant kingdoms were constructed largely out of the imagination. Discussions were rife concerning the ancestry of vertebrates or of arthropods, or of many other groups of animals or plants. Hypotheses were invented to explain supposed facts of heredity or variation which had no real existence, and in general speculation was inversely proportional to evidence. Inevitably there was a growing dissatisfaction among men with scientific instincts against these mere speculations—dissatisfaction which was expressed emphatically by Bateson and Whitman, and many others. I well recall a statement of the late Professor Watase, of the Imperial University of Tokyo, which expressed the opinion of many other workers with whom he was associated at the Marine Biological Laboratory at Woods Hole, "I am through with this whole phylogeny business."

The present era is one of experiment, of both analysis and synthesis, of a union of morphology and physiology. It began in the last decade of the nineteenth century with the rise of "Entwicklungsmechanik" under Roux (1890), the "Experimental Morphology" of Davenport (1897), and the "Experimental Evolution" of DeVarigny (1892). Biology was no longer a mere collection of facts nor of speculations about those facts, but rather an analysis of causes. The genesis of individuals and of species was then and is still the great problem upon which biologists are engaged, but continually it is being attacked by new and more accurate methods.

In 1900 came the rediscovery of Mendel's great work on heredity, and in 1902 came Bateson's translation and additions to this work, and the new era was in full swing. At this auspicious time came the establishment of the Carnegie Institution of Washington, "to encourage in the broadest and most liberal manner, investigation, research and discovery, and the application of knowledge to the improvement of mankind."

Professor Osborn had said in 1890, "When we have reached a heredity theory that will explain the phenomena of inheritance, the method of evolution will itself be a problem of the past." The principles of Mendel furnished such a theory, and in May, 1902, Dr. C. B. Davenport, then associate professor of zoology at the University of Chicago, submitted plans to the trustees of the Carnegie Institution for the establishment of a "Station for Experimental Evolution." At nearly the same time, the late Dr. A. G. Mayer proposed plans for a "Department of Marine Biology," and shortly after, Dr. D. T. MacDougal proposed the establishment of the "Desert Botanical Laboratory." All of these projects were approved by the trustees, and later they established the "Nutrition Laboratory" under the direction of Dr. F. G. Benedict, and the "Department of Embryology" under the direction of the late Dr. Mall. Thus the Carnegie Institution has established five departments in different branches of biology, and in addition it has supported the research work of many biological investigators not connected with any of these departments. It is probably true that the work of these departments and investigators has done more to develop this new era in biology than has that of any other institution in the world.

It would be impossible in the time at my disposal to comment upon even the most important investigations which have been carried on under the auspices of the Carnegie Institution, and it would be invidious in me to attempt to estimate the value of these different lines of work. Coming down on the train this morning it seemed to me, as I talked with many members of our party, that almost all of them, who are now scattered over the length and breadth of the land, had at one time or another been workers at this station. But without attempting any complete statement regarding the work of the station, it is fitting that I should mention a few of the outstanding workers and their investigations.

Dr. George H. Shull informed me this morning that he was the first member of the staff of the Station for Experimental Evolution to arrive on the ground in May, 1904, and very soon thereafter he began his extensive work on heredity and mutation in the evening primrose and other plants, and also on the increased vigor of hybrids. Associated with this work was the really epoch-making discovery of Miss Lutz that different numbers of chromosomes are found in various mutants of the evening primrose. It was thus established that mutations may be due to changes in the number of chromosomes as well as to intra-chromosomal mutations.

Dr. Davenport's extensive studies on the inheritance in man of feeble-mindedness, epilepsy, color of eyes and hair, skin color in negro-white crosses, twins and many important human traits have contributed greatly to our knowledge of these subjects.

Dr. Laughlin's studies of the racial stocks in our population and among the inmates of custodial institutions, and on the eugenical aspects of sterilization have formed the basis of important reports to Congress. They were at first conducted in the Eugenics Record Office, established by the generous cooperation of Mrs. E. H. Harriman. In 1920 the Record Office was combined with the Station for Experimental Evolution under the title of the "Department of Genetics," and the work of the office has been expanded so as to include important studies on heredity

in certain domestic animals, particularly the race-horse.

I must mention also Dr. MacDowell's important investigations of the transmitted effects of alcohol on rats as well as on the rate of growth in mice; Dr. Little's studies on the inheritance of cancer in mice; Dr. Riddle's demonstration of a chemical basis for sex differences in pigeons as well as a study of the effects of endocrines upon sex and metabolism; Dr. Metz's discoveries regarding the cellular basis of heredity in different species of flies, a real comparative study of chromosomes and genes in different species and genera; Dr. Banta's studies of sex intergrades in the water flea; Dr. Blakeslee's investigations of sex in moulds; and last, but not least, the remarkable discoveries of Blakeslee and Belling on the many mutants of jimson-weed, and the cellular basis of these mutations.

This is a very incomplete list of some of the remarkable accomplishments of this department. These studies are spread over the living world from moulds to man, and yet all form an integral part of the original program proposed by Dr. Davenport, namely: "the study of variation, inheritance, adjustment, as factors of evolution." The experience of this station demonstrates the great value of prolonged and continuous work on well-selected forms. It fulfils the purpose of the Carnegie Institution "To encourage in the broadest and most liberal manner investigation, research and discovery, and the application of knowledge to the improvement of mankind."

EDWIN G. CONKLIN

PRINCETON UNIVERSITY

TO-DAY we are meeting to celebrate the twenty-fifth anniversary of the inauguration of the research activities of the Carnegie Institution, and it is my privilege to address to the members of its department of genetics a few words of appreciation of the great work which the department has undertaken, and to congratulate its members upon the distinguished results which they have already achieved.

Among the many beneficent foundations established by Mr. Andrew Carnegie, the Carnegie Institution of Washington must always hold a foremost place. Founded by him "to encourage in the broadest and most liberal manner investigation, research and discovery, and the application of knowledge to the improvement of mankind," it has always been guided by the fundamental purpose of the founder—the conduct of scientific research for the improvement of mankind, and the achievement of the higher welfare of the individual.

It is fortunate for the carrying out of the great object for which our institution was created that we have as its president and guiding spirit that distinguished scientist and philosopher, Dr. John C. Merriam, who is devoting his life to the improvement of human affairs and the establishment of the ways of peace, for which our great founder so earnestly labored and which he so fervently desired.

It has been my good fortune to be associated with Dr. Merriam as one of the trustees of this institution, and like all who have the privilege of working with him I have marveled at his comprehensive knowledge of the sciences, and have felt the influence of his great wisdom and scholarship. While by the nature of his duties he is constantly active in the prosecution and coordination of scientific research in all of its branches, he never loses sight of the fact that the ultimate integration of scientific discovery and research will achieve its greatest purpose when applied to the problem of the human individual.

To this problem, under the leadership of Dr. Charles B. Davenport, those distinguished scientists who constitute the staff of the department of genetics are directing their energies. I will not undertake to describe their work, for these master scientists are soon to take us through their laboratories where, in their own way and far better than I could do, they will explain the nature of their problems, their method of attack, and exhibit—all too modestly, let me warn you—some of their latest achievements.

It is difficult at first sight to understand what good is to come from growing jimson-weeds in clay pipes and thimbles; from studying the color of the eyes of insects, and the size of the wings of different species of flies, and noting the behavior of doves, and the form of the head of water fleas. But these and many other experiments which might at first seem trivial and of no practical value are all undertaken because they are calculated to throw light on the unsolved problems of heredity and environment, and because they may yield scientific knowledge of profound importance in solving the problem of man himself.

The awful spectacle of the increasing numbers of the mentally sick, the prevalence of nervous diseases, and the generally disturbed condition of the nations, have caused many to believe that we are headed in the wrong direction, and that our ideals should be those of the so-called simple life, or that we should seek to attain to the static condition of ancient China. Were it not for my faith in the ultimate success of such researches as you are conducting in this institution, I believe that I too would share these views and be inclined to the opinion that in merely material progress we had gone far enough—perhaps too far, or too fast.

While I have frequently asserted that human behavior presents the most important and the most formidable problem of all the ages, I believe that its

solution can be achieved. While in this problem we should not ignore the claims of religion and philosophy, it would be a mistake to conclude that we have gone too far and too fast, and that we must restrict the progress of science in material things. On the contrary, we must accelerate our progress in all the sciences, for the knowledge thus to be gained will be required in preparing the individual man to function as a sane and peaceful unit in the ultimate social organism. I believe that the problem of human behavior can be solved, but not without profound and prolonged researches which shall bring to bear upon every phase of the subject all of the resources of science.

In order to solve the problem of the human personality we must push forward the advances of pure science in all directions without exception. This is the great mission of the Carnegie Institution which it is carrying out with the highest distinction. The pure scientist in whatever field he may be working is an explorer who is constantly extending our knowledge of the realities of our environment. The applied scientist is providing agencies so that we may adjust ourselves to these realities. By the aid of that unified knowledge which should be the aim of philosophy, education must expound the principles by which the individual shall make this adjustment.

In carrying out this campaign of research directed at the human problem, we must not confine ourselves to the operations of the biologists and others engaged solely in biological or medical research. We must encourage and utilize the work of the chemist and the physicist which is perhaps often conducted without any conscious regard to the human problem. The work of the physical scientist has already been of priceless importance in forwarding the work of medical research. Numberless examples of this are to be found. The microscope, the spectroscope and the X-rays are but a few of those that I may mention, to say nothing of those recent contributions of the chemist in analyzing the wonderful substances produced by the ductless glands, the functions of which affect so profoundly the health of the human body. This list could be extended indefinitely.

Even the astronomers are contributing towards the solution of the problem of the human personality. At the Mount Wilson station of the Carnegie Institution in California, and at the California Institute at the base of the mountain, a distinguished group of scientists endowed by the Carnegie Institution is conducting a systematic attack on the problem of the ultimate constitution of matter. On the mountain, the astronomers are observing in the sun and in the stars and in the nebulae not only worlds in process of evolution, but what is most astonishing, the evolution of the elements themselves. At the base of the mountain, the chemists and physicists are reproducing upon the earth, with increasing success, conditions which have been discovered in the depths of the universe. They are doing a marvelous work, and are achieving results which in the years to come will be of the utmost value in solving the problem of the human individual.

When these and other scientists working in different parts of the world have progressed in the mastery of the knowledge of the structure of the atom, when consequently perhaps some physicist devises a super-optical method which may enable us to view on the largest desirable scale the details of the animal cell, we shall then have a contribution of incalculable importance to the human problem.

To me, this celebration to-day is an event of the deepest significance, for it indicates the beginning of a new era of social development. As Trotter so well puts it:

> The method of leaving the development of society to the confused welter of forces which prevail within it is now at last reduced to absurdity by the unmistakable teaching of events. The conscious direction of man's destiny is plainly indicated by Nature as the only mechanism by which the social life of so complex an animal can be guaranteed against disaster and brought to yield its full possibilities.
>
> A gregarious unit informed by conscious direction represents a biological mechanism of a wholly new type, a stage of advance in the evolutionary process capable of consolidating the supremacy of man and carrying to its full extent the development of his social instincts.

Human progress need no longer be left solely to chance. By the aid of science it can be brought under our conscious control.

So vast are the problems of this control which lie ahead of us and which can be solved only by the aid of science that the total activities of the Carnegie Institution, great as they now are, should be increased a hundredfold. Scientific research in our universities and elsewhere, conducted solely for the advancement of knowledge, should be increased in like measure. If this is done, I believe that in the fulness of time by further scientific discoveries the physical development of man will be improved, that many diseases will be entirely eliminated, and that immunity to the others will be achieved, and that feeble-bodiedness and feeble-mindedness will disappear.

In concluding, let me say that if we rightly interpret the work of these scientists which we are briefly to examine to-day, we shall find that it is directed ultimately to the overcoming of the defects both of body and mind which are found in the individual man, and which now prevent him from properly performing his

function as a member of society. We shall also I think be made to feel that in the great plan of creation, the highest part has been assigned to man; for he must direct the development of that social organism which has been foreshadowed "with its million-minded knowledge and power, to which no barrier will be insurmountable, no gulf impassable and no task too great."

JOHN J. CARTY

EARLE MELVIN TERRY—1879–1929

EARLE MELVIN TERRY, professor of physics and a member of the department of physics at the University of Wisconsin since 1902, died of acute heart failure at his home on the night of May 1.

He was born on a farm near Battle Creek, Michigan, on January 16, 1879. Entering the University of Michigan in 1898, he largely worked his way through, specializing in physics, although he kept up throughout his work in the classics. This gave him a broad and balanced education, all too unusual in the specialist, and it may be of interest to recall that a quarter of a century later he was still able to tutor his son in Latin. After getting his A.B. degree in 1902 he came to Wisconsin as an assistant in physics and two years later was made an instructor, getting his doctorate in 1910 and advancing eventually to a professorship.

Terry was a rather unusual combination of a keen research worker and first-class teacher. His investigations were all characterized by a highly developed and skilful technique, whether along the magnetic lines which first engaged his attention, or vacuum tube design, quartz crystal frequency control and other radio problems which occupied him latterly. He also published theoretical investigations on oscillating circuits and was one of the collaborators on the National Research Council bulletin on "Magnetism." On the day of his death he had just finished the last page of the revision of his well-known laboratory manual of electrical measurements.

He was a pioneer in the radio field. Somewhat before 1910 came the first practical development of wireless telegraphy in this country, and Terry at once turned his attention in this direction. With the advent of radio telephony, interest was centered on this much more practical and interesting application of wireless waves. He wanted to have a local broadcasting station, but the patent situation regarding the tubes was such that they could not be obtained on the market. Nothing daunted, he at once set about making the tubes himself. He developed in a remarkably short time the difficult glassblowing technique and when station WHA was opened, as the first university station and, so far as is known, the second broadcasting station in the country, it was operated entirely with these tubes. Many students in the laboratory will recall having seen a set of these old tubes with in-seals colored red. Some one asked Terry about them once, and he explained:

"You see I started making those particular tubes on Christmas day and I used red sealing-in glass by way of celebrating a little."

When this country entered the war in 1917, Terry was one of the small group of Wisconsin physicists chosen to carry on submarine detector research at New London, Connecticut. One of the most successful types of detector was developed largely by this group, and at the close of the war it was installed on a number of destroyers and had already been primarily responsible for the destruction of several of the under-sea craft.

It is perhaps as a teacher, however, that Terry will be longest remembered. His personality, which won students from the start, and the interest in physics which he aroused in them, combined to make the experience in his classes one not to be forgotten. He especially liked to teach engineering students, and his relationships with this group were always particularly happy. His method of conducting classes was direct and simple. He scorned all special devices for getting the student to work, or "nursing" him along. The student either worked hard—or took his medicine. Students came to talk over their problems with him to such an extent that he was forced at times to shut himself in to be able to accomplish his own investigations.

The University of Wisconsin has recently suffered an unparalleled series of losses by death of men who can not be replaced, and Terry is one of the foremost of these. His influence as an outstanding teacher, tireless investigator and loyal friend will long be felt by all who have come in contact with him.

L. R. INGERSOLL

SCIENTIFIC EVENTS

PUBLIC HEALTH UNDER THE FEDERAL GOVERNMENT

Two bills relating to the public health service have been introduced by Representative Parker (Rep.), of Salem, N. Y., chairman of the House Committee on Interstate Commerce. Both bills have been referred to the House Committee on Interstate and Foreign Commerce.

They are as follows: H. R. 3143 proposes to establish and operate a National Institute of Health, to create a system of fellowships in the institute and to authorize the government to accept donations for use

in ascertaining the cause, prevention and cure of disease affecting human beings. The institute would be under the jurisdiction and administrative control of the Public Health Service. The bill says the Hygienic Laboratory shall hereafter be known as the National Institute of Health, occupying the same site in the District of Columbia. It would direct the Secretary of the Treasury to submit to Congress from time to time plans and estimates of appropriations to carry out this proposed act.

H. R. 3142 proposes to coordinate health activities of the government. It provides that upon the request of an executive department or of an independent establishment which is carrying on a public health activity, the Secretary of the Treasury is authorized to detail officers or employees of the Public Health Service to such department or establishment in order to cooperate in such work.

It would authorize the Surgeon-General of the Public Health Service to detail personnel of the Public Health Service to educational and research institutions for special studies of scientific problems relating to public health and for dissemination of information relating to public health and to extend the facilities of the Public Health Service to health officials and scientists engaged in special study.

It also would authorize the Secretary of the Treasury to establish additional divisions in the Hygienic Laboratory in the District of Columbia as agencies for solution of public health problems. It specifies that the administrative office and bureau divisions of the Public Health Service in the District of Columbia shall be administered as a part of the departmental organization and the scientific offices and research laboratories of the Public Health Service shall (whether or not in the District of Columbia) be administered as a part of the field service.

Besides providing for appointments and promotions and other details, the bill provides among other things that the officer detailed as chief of the narcotics division of the Public Health Service shall, while so serving, be an assistant surgeon-general. It provides that hereafter the advisory board for the hygienic laboratory shall be known as the National Advisory Health Council.

THE TENNESSEE ACADEMY OF SCIENCE

THE Tennessee Academy of Science held its spring meeting at Memphis and Reelfoot Lake on Friday and Saturday, May 26 and 27. Sessions were held on Friday morning and afternoon and on Saturday morning in the Peabody Hotel, Memphis, and on Saturday evening in the Walnut Log Lodge, Reelfoot Lake. The president of the academy, P. E. Cox, Tennessee state archeologist, presided at the meeting.

The program of thirty papers and addresses embraced not only subjects in various branches of science, including physics, chemistry, biology, archeology, psychology, sociology, bacteriology and pharmacology, but several of more general interest such as "Some Phases of Flood Control on the Mississippi River," with special reference to the work now in progress in the Memphis district, by Lieutenant-Colonel F. B. Wilby; "Progress of Mosquito Control and Malaria Control," by J. A. LaPrince, of the U. S. Public Health Service; "County-wide Screening Program for the Control of Malaria in Lake County, Tennessee," by Howard R. Fullerton, of the Tennessee Public Health Department; "The Geology of Reelfoot Lake," by Walter F. Pond, state geologist of Tennessee, and "The Story of Reelfoot Lake," by the Honorable Thomas O. Morris, of Obion, Tennessee.

The session on Friday morning opened with an address of welcome by the Honorable S. Watkins Overton, mayor of Memphis. At the dinner on Friday evening in the Hotel Peabody ballroom, the speakers were the Right Reverend Thomas F. Gailor, bishop of Tennessee Episcopal Church, and Dr. M. W. Stirling, chief of the Bureau of American Ethnology. The Memphis members of the academy provided automobiles for the excursion to Reelfoot Lake on Saturday afternoon and return to Memphis on Sunday afternoon.

The officers of the academy are:

P. E. Cox, *president,* Memorial Building, Nashville.

A. Richard Bliss, Jr., *vice-president,* 175 Granville Place, Memphis.

J. T. McGill, *secretary-treasurer,* Vanderbilt University, Nashville.

Jesse M. Shaver, *editor,* George Peabody College, Nashville.

The next meeting of the academy will be held at Nashville, November 29, 1929.

JOHN T. MCGILL,
Secretary

THE SEVENTH COLLOID SYMPOSIUM

THE Seventh Colloid Symposium will be held at the Johns Hopkins University on June 20, 21 and 22. The following program of papers has been announced by the chairman of the symposium, Professor Harry B. Weiser, The Rice Institute, Houston, Texas.

Frederick G. Donnan, University College, London, "The Scattering of Light in Sols and Gels."

S. E. Sheppard and J. G. McNally, Eastman Kodak Company, "The Anisotropy of Gelatin Gels."

Harvey A. Neville and E. R. Theis, Lehigh University, "The Measurement of the Hydration of Gelatin and Related Materials and the Relation of Hydration to Swelling."

K. F. Herzfeld, the Johns Hopkins University, "Surface Properties of Crystals."

Wesley G. France, the Ohio State University, "Crystal Structure and Adsorption from Solution."

A. Frumkin, Karpow Chemical Institute, Moscow, "Theory of Electrocapillarity."

James W. McBain and Robert C. Williams, Stanford University, "A Determination of the Number of Free Electric Charges on Air Bubbles and Oil Droplets Dispersed in Water Containing a Small Amount of Cetyl Sulfonic Acid."

H. B. Bull, the University of Rochester, "The Electrostatics of Flotation."

Donald H. Andrews, the Johns Hopkins University, "Some Evidence on the Nature of Extra Molecular Forces."

W. A. Patrick, the Johns Hopkins University, "The Adsorption of Vapors."

F. E. Bartell and Ying Fu, the University of Michigan, "The Specific Surface Area of Activated Carbon and Silica."

Wilder D. Bancroft, C. E. Barnett and B. S. Belden, Cornell University, "Compound Formation with a Volatile Base or Acid."

Otto Reinmuth, University of Maryland, and Neil E. Gordon, the Johns Hopkins University, "Nature of Interaction between Hydrous Oxides and Mordant Dyes."

Frank K. Cameron and R. A. Lineberry, the University of North Carolina, "Apparent Specific Gravity and Moisture Content of Clays."

Edgar T. Wherry, Clarence S. Ross and Paul F. Kerr, Bureau of Chemistry and Soils, U. S. Department of Agriculture, "Progress in the Study of the Clay Minerals."

K. D. Jacob, W. L. Hill and R. S. Holmes, Bureau of Chemistry and Soils, U. S. Department of Agriculture, "Some Colloidal Properties of Finely Divided Natural Phosphates."

Eugene C. Bingham, Lafayette College, "The Nature of the Different Types of Plastic Flow."

Harry N. Holmes and C. J. B. Thor, Oberlin College, "Adsorption of Fats."

E. S. Paine, Bureau of Chemistry and Soils, U. S. Department of Agriculture, "The Colloids of the Sugar Liquors."

Treat B. Johnson, Yale University, "The Chemistry of Bacteria and the Development of a Practical Technique for the Chemical Analysis of Cells."

S. DeW. Ludlum, A. E. Taft and R. L. Nugent, the Gladwyne Research Laboratory, "Human Blood Serum as a Colloidal System."

J. E. Sweet, Cornell University Medical College, "The Liesegang Phenomenon in Gall Stones."

J. C. W. Frazer, the Johns Hopkins University, "A Study of the Porous Disc Method of Measuring Osmotic Pressures in Aqueous Solutions."

Harry B. Weiser, The Rice Institute, "Adsorption and the Permeability of Membranes."

THE EARLIEST MOTION PICTURES

ON May 8, Stanford University held a semi-centennial celebration in commemoration of the motion picture research conducted by Leland Stanford at his Palo Alto stock farm in 1878 and 1879 with the assistance of Eadweard J. Muybridge and John D. Isaacs. It is believed that this is the first investigation to make use of consecutive instantaneous pictures and, therefore, lies at the basis of the photographic analysis of motion and also the portrayal of movement through the motion picture. Something over two thousand such pictures were taken by Muybridge. Many of those that had to do with the locomotion of the horse were later analyzed by Dr. J. D. B. Stillman, whose book, "The Horse in Motion," was published in 1882. Official delegates from the Academy of Motion Picture Arts and Sciences took part in the exercises. Tablets commemorating the Stanford-Muybridge research were unveiled, one in Memorial Court at the main quadrangle of the university and the other, a duplicate, near the site of the Muybridge studio. Dr. Walter R. Miles, professor of experimental psychology at Stanford University, gave two addresses, "The Stanford-Muybridge Research on the Portrayal of Motion" and "Technique and Results of the Palo Alto Experiments." Other speakers and addresses were as follows: Louis B. Mayer, vice-president of the Metro-Goldwyn-Mayer Corporation, "The Debt of Motion Pictures to the Early Researcher"; Louis H. Tolhurst, motion picture technician, Hollywood, "Evolution of the Motion Picture"; Dr. Alonzo E. Taylor, director of the Food Research Institute, Stanford University, "The Cost and Value of Research"; William C. De Mille, vice-president of the Academy of Motion Picture Arts and Sciences, "The University of the Future of Motion Pictures"; Dr. Robert E. Swain, acting president of Stanford University, "The Relation of the University to Industrial Progress." A talking picture address by the Honorable Ray Lyman Wilbur was made possible through a portable outfit recently developed in the Bell Telephone Laboratories. This address for a specific occasion and presented in a college banquet hall marks an advance in motion pictures that is of much educational significance.

THE INAUGURATION OF RESEARCH BY THE CARNEGIE INSTITUTION OF WASHINGTON

ON May 31, at Cold Spring Harbor, Long Island, the Department of Genetics of the Carnegie Institution of Washington was "at home" to invited guests. The reception was held in celebration of the conclusion of the first quarter century of the work of the institution founded by Andrew Carnegie for the conduct

of research. Representatives of some sixty institutions, organizations and departments of research were among the two hundred or more guests who accepted the invitations of the president and trustees of the institution.

At eleven o'clock the guests assembled in a tent erected on the grounds. Addresses were given by General John J. Carty, representing the trustees; by Dr. E. G. Conklin, head of the department of biology, Princeton University, representing scientific men, and by Dr. John C. Merriam, president of the Carnegie Institution, representing the staff. Dr. Henry S. Pritchett, vice-chairman of the board of trustees, presided.

The remainder of the day was spent in talking with the investigators and in inspecting the exhibits which the staff had prepared to illustrate their methods of investigation and somewhat of the results that have obtained. These exhibits were open to public inspection on June 1 and 2.

The station for experimental evolution, now the department of genetics, was formally opened on June 11, 1904. It was established under the direction of Dr. Charles B. Davenport. The eugenics record office was founded in 1910 by Mrs. E. H. Harriman and transferred eight years later to the institution, with an endowment. In 1921 a reorganization of the department was effected, by which the work of experimental evolution and human heredity was combined into a department of genetics, Dr. Davenport continuing as director.

SCIENTIFIC NOTES AND NEWS

DR. L. R. JONES, professor of plant pathology at the University of Wisconsin, has been invited to act as president of the section of mycology and plant pathology of the Fifth International Botanical Congress to be held in Cambridge in 1930. Dr. E. D. Merrill, dean of the college of agriculture of the University of California, will be a vice-president of the section on taxonomy.

DR. FRANCIS G. BENEDICT, director of the nutrition laboratory of the Carnegie Institution of Washington, Boston, on May 6, following a lecture before the medical faculty of the University of Hamburg, was presented by the dean, Professor Paul Sudeck, the eminent surgeon, with the gold honor medal of the university "in recognition of his successful work in metabolism and physiology."

CHARLES M. ALLEN, professor of hydraulics at the Worcester Polytechnic Institute, will receive the degree of doctor of engineering at the commencement exercises on June 14.

A DINNER in honor of Dr. Aven Nelson, professor of botany and president emeritus of the University of Wyoming, was tendered on May 13 by his colleagues of the board of trustees, of the university faculty and of the administrative staff on the occasion of the completion of his seventieth year of life and forty-second in the service of the university.

A PORTRAIT painted by Boris Luban of Henry Hurd Rusby, dean of the college of pharmacy of Columbia University, who for forty-one years has served as professor of botany, physiology and materia medica, was presented to him by the student body on June 3, in the presence of pharmacists from all over the country, as part of the college centennial and commencement exercises.

ON April 5, Dr. E. P. Mathewson, past-president of the American Institute of Mining and Metallurgical Engineers and professor of administration of mineral industries at the University of Arizona, was made "a member with distinction" in Tau Beta Pi. The initiation took place at the university and was followed by a dinner.

DR. W. REID BLAIR, director of the New York Zoological Park and professor in New York University, was recently elected a resident member of the Authors' Club, New York.

THE council of the Royal Meteorological Society, as reported in *Nature*, has sent a message of congratulation and good wishes to the society's honorary member, Professor Hugo Hergesell, director of the Lindenberg Observatory, on the occasion of his seventieth birthday which occurred on May 29. Addresses of congratulation were presented to him by learned societies and official bodies in Germany in recognition of his services to meteorological science and its application to aviation.

THE honors awarded on the occasion of the birthday of King George of England include a knighthood conferred on Dr. Peter Chalmers Mitchell, F.R.S., secretary of the Royal Zoological Society.

DR. W. A. JOLLY has been elected president of the Royal Society of South Africa.

DR. G. CANBY ROBINSON, director of the New York Hospital-Cornell Medical College Association, has been elected president of the Harvey Society for the ensuing year.

THE fourth annual meeting of the Hawaiian Academy of Science was held at Honolulu from May 9 to 11. Officers for the coming year are as follows: *President*, Dr. Harold S. Palmer; *vice-president*, Dr. Harold L. Lyon; *secretary-treasurer*, Mr. E. L. Caum, and *councilor*, Mr. R. T. Aitken.

THE newly elected officers of the Society for Experimental Biology and Medicine are: *President,* Dr. Peyton Rous; *vice-president,* Dr. David Marine; *secretary-treasurer,* Professor A. J. Goldforb; *councilors,* Professor F. P. Gay and Professor G. B. Wallace.

PROFESSOR GEORGE W. CORNER, head of the department of anatomy of the University of Rochester Medical School, has joined the summer staff of the biological laboratory of the Long Island Biological Association at Cold Spring Harbor. This summer he will be in charge of the course of surgical methods in experimental biology. Dr. Justin Andrews, of the school of hygiene and public health of the Johns Hopkins University, who was announced as being in charge of the course, has obtained a leave of absence to carry on research at the Island of Grenada.

LAWRENCE T. CLARK has been appointed head of the laboratories of Parke, Davis and Company, succeeding Dr. E. M. Houghton, who retired on May 1, after serving for thirty-four years. Dr. Oliver Kamm, who was recently awarded the annual prize of the American Association for the Advancement of Science, has been made scientific director.

W. J. BEAN has resigned from the office of curator at Kew Gardens after serving forty-six years. Mr. Bean was a pupil during the administration of Sir Joseph Hooker and has served under three chiefs besides Sir Joseph—Sir William Thiselton Dyer, Sir David Prain and Dr. Hill.

DR. CHARLES R. STOCKARD sailed on June 3 for Europe. During his absence all manuscripts intended for *The American Journal of Anatomy* should be sent directly to the Wistar Institute in Philadelphia or to one of the associate editors—Dr. G. L. Streeter or Dr. H. D. Senior.

DR. F. L. RANSOME, professor of economic geology in the California Institute of Technology, sails from New York on June 19 to attend the Fifteenth International Geological Congress to be held at Pretoria, South Africa. Dr. Ransome goes as a delegate from the National Academy of Sciences, the National Research Council, the Geological Society of America, the American Institute of Mining and Metallurgical Engineers and the California Institute of Technology. He expects to spend some time at the copper mines of Northern Rhodesia after the session of the congress.

PROFESSOR HOWARD BARNES, head of the department of physics of McGill University, has joined an expedition led by R. B. Van Horne, of Montreal, president of the Cuban Railway Company, for the study of icebergs.

DR. PEYTON ROUS, of the Rockefeller Institute for Medical Research, delivered the Linacre Lecture of St. John's College, Cambridge, on May 6. The title of the lecture was "The Modern Dance of Death."

THE annual public address under the auspices of the Sigma Xi Club, of West Virginia University, was given on May 27 by Dean William E. Henderson, of the Ohio State University. His subject was "The Responsibility of Science."

A. E. WIGGAM will give on June 9 an address on the occasion of the laying of the cornerstone of the new Colgate Chemical Laboratory which has been built at a cost of $400,000. His subject will be "Science as a Way of Life."

A LECTURESHIP has been established in the Medical School of Loyola University, Chicago, by the Loyola chapter of the medical fraternity Phi Beta Pi in memory of the late Dr. Samuel A. Matthews, who was professor and head of the department of physiology, pharmacology and therapeutics from 1919 to 1928. The first of these lectures was given on May 20 by Dr. Arthur L. Tatum, professor of pharmacology at the University of Wisconsin, on "A Physiological Interpretation of Morphine Addiction."

THE committee in France which is endeavoring to collect funds for a suitable recognition of the centenary of Paul Schutzenberger, has available a plaquette, designed by Professor G. Urbain, of the Sorbonne, who is a sculptor as well as a distinguished chemist, which will be sent in bronze to those contributing 100 francs or in silver to those contributing 1,000 francs. American chemists and other men of science are invited to contribute.

PROFESSOR INEZ WHIPPLE WILDER, chairman of the department of zoology at Smith College since the death of her husband, Harris H. Wilder, a year ago, died on April 28 at the age of fifty-eight years.

M. EMILE CHAIX has died in Geneva at the age of seventy-four years. He was professor of geography at the University of Geneva and was known for his studies on the South Italian volcanoes and the Savoy Alps and for his work on sea erosion in Normandy and the Channel Islands.

COMMENDATORE LANCIANI, senator of the Kingdom of Italy and formerly professor of Roman topography in the University of Rome, died on May 21 at the age of eighty-three years.

A BRONZE portrait plaque of the late Sir William Schlich was unveiled in the school of forestry at the University of Oxford on May 23 by the vice-chancellor, Dr. F. W. Pember. Sir William Schlich was at one time inspector-general of forests to the Government of India, and afterwards professor of forestry at Cooper's Hill and later at the University of Oxford. In addition the forestry commissioners will set apart an area of forest to be named the Schlich

Forest, situated if possible within easy reach of Oxford, which will be available for experimental work. Subscriptions amounting to about £1,700 have already been received, which will be paid each year in rotation to different parts of the empire and to the United States, and will be devoted to some purpose calculated to further the cause of forestry. This year payment of the interest has been made for the first time, and Australia is the recipient. The trustees decided that in the present instance the memorial should take the form of a gold medal, to be awarded annually to the best student at the Australian Forestry School at Canberra.

THE Museums of the Peaceful Arts, New York City, unveiled the transatlantic plane *Bremen* in the Grand Central Station on May 21 before an audience of 17,000, including many of distinction. Colonel Fitzmaurice and Mayor Walker spoke in connection with the unveiling ceremonies. These ceremonies were taken by the Pathé Sound Movies. Prior to the unveiling a luncheon was given at the Commodore to about four hundred guests. President Frederic B. Pratt presided. The *Bremen* is to hang in the Grand Central Terminal, above the *De Witt Clinton*, until the museum has moved into its permanent home.

THE fourth annual spring meeting of the Oklahoma Academy of Science was held May 10 to 12 in the Arbuckle Mountains of southern Oklahoma. There were 178 persons registered from Oklahoma and Texas. This year special emphasis was placed on the study of botany, but additional walks and trips were given for those interested in geology, birds, insects and ecology. Botany studies included herbaceous plants, trees, grasses, ferns and mosses. Evening addresses were given on the following subjects: grasses, geology of the Arbuckle Mountains, botanical gardens, Oklahoma trees, poisonous animals and stars. Buildings and cottages at the Baptist Assembly ground at Prices Falls were used for sleeping quarters, and meals were served in the camp dining-room under the direction of the academy. Dr. Chas. N. Gould, director of the Oklahoma Geological Survey, was in charge of the program.

SIGMA PI SIGMA, national honorary physics fraternity, installed its Theta chapter on June 3 at West Virginia University. The installation was conducted by Dr. Marsh W. White, national secretary of the society. In addition to the undergraduate group five members of the physics faculty staff were admitted as charter members, including Dr. Robert C. Colwell, head of the department of physics. The chapter officers are: Ralph G. Owens, *president;* Ira O. Myers, *vice-president;* Charles D. Thomas, *secretary;* Charles W. Hawley, *treasurer.*

ON April 22, a meeting of physicians interested in pathology was held in the county medical rooms in San Francisco and there was formed an organization to be known as the San Francisco Pathologic Society. A constitution and by-laws were adopted and the following officers were elected: Wm. Ophuls, *president;* G. Y. Rusk, *vice-president;* Z. E. Bolin, *secretary-treasurer.* An executive committee was elected consisting of C. L. Connor, A. M. Moody and W. T. Cummins. The object of the society is to foster knowledge on the Pacific Coast. It is interesting to note that a similar society was formed in 1851 in San Francisco and that this was one of the earliest medical organizations on the Pacific Coast.

THE seventeenth annual meeting of the American Association of Agricultural College Editors will be held at the University of New Hampshire, at Durham, from July 9 to 12. At the meeting this year M. S. Eisenhower, director of the office of information, and E. E. Gapen, chief of the press service, will serve as members of the committee selected to judge the exhibits of bulletins, posters and press material.

THE next conference of the American Country Life Association will be held at Iowa State College at Ames, from October 17 to 20. The general topic will be "Rural Organization." The program committee, of which W. H. Stacy, of Ames, is acting as secretary, is developing a program based upon the combination of sectional meetings for open forum discussions of various phases of rural organization and for general sessions with prominent speakers of national repute. A memorial session in memory of the late Honorable Henry C. Wallace, former secretary of the U. S. Department of Agriculture, as a recognition of the large part which Mr. Wallace played in the improvement of rural life in America, will be one of the outstanding features of the program.

AT the thirty-second annual session of the American Gastro-Enterological Association, held at Atlantic City, N. J., from May 6 to 7, 1929, Dr. Frank Smithies, Chicago, donated a fund with the object of the association's securing annually a guest speaker of national prominence in research work. The proceeds of the fund assure an honorarium to the invited guest of $100. This annual address is to be known as "The Walter C. Alvarez Lecture."

THERE is being constructed at the biological laboratory of the Long Island Biological Association at Cold Spring Harbor, Long Island, a biophysical laboratory. This is in furtherance of a program of research in biophysics to be carried on throughout the year. This program was inaugurated last year, at which time Dr. Hugo Fricke, formerly director of the department of biophysics of the Cleveland Clinic

Foundation, was appointed to take charge of the work. The building is of tile and concrete construction, sixty-four by thirty-eight feet, and one story high. It will contain four research rooms (including a large chemistry laboratory and a large X-ray room), a receiving room, a room for records and a machine shop. It will be equipped with biophysical apparatus and machines, and, in addition, every effort is being made to make the research rooms relatively soundproof and free from vibration, and of comparatively constant temperature. The building will be in use this summer.

THE Imperial Bureau of Soil Science, one of the eight bureaus the formation of which was recommended by the Imperial Agricultural Research Conference of 1927, has commenced work at the Rothamsted Experimental Station. Sir John Russell, director of Rothamsted, is also the director of the bureau, and Dr. A. F. Joseph, lately Sudan Government chemist, has been appointed deputy director. The functions of the bureau include the collection and distribution of all research work of importance on soils to the British Empire, the assistance of research workers in the prosecution of their investigations in whatever ways it can, the bringing together of workers from different parts of the Empire (either by correspondence or in conference) interested in the same subjects and to supply information generally which may facilitate the work of soil experts in the development of agriculture. It is hoped that before long the bureau will be in close touch with all soil investigators of the Empire, both at home and abroad, and that by means of information-circulars and other methods, the results of studies carried on in one part of the Empire will be made available for all. Arrangements will also be made to supply information dealing with soil investigations in foreign countries, the results of which (owing to language or other difficulties) are not readily available.

THE London *Times* writes that a project for research into agricultural and stock-raising problems is rapidly developing among widely scattered parts of the British Empire. Last December it was proposed to the governments of the Empire that eight bureaus for the collection and interchange of such information be established. These bureaus were to be attached to recognized, already existing research institutes, and the necessary finance connected with them was to come from a common fund to which the governments would subscribe. Officials of all the institutes who have been approached have all agreed to the plan and all the Empire governments have agreed to support it. All the bureaus will be in various parts of the British Isles, and the scientific men who will direct them are Dr. John J. B. Orr, Professor F. E. Crew, R. G. Hatton, Dr. Sir John Russell, Dr. W. H. Andrews, Sir Rowland Biffen, Professor F. E. Stapledon and Dr. W. Leiper. All will be in operation before the end of the coming summer.

A RECORD of the latest scientific developments in the improved utilization of bituminous coal as a raw material is now available in the published proceedings of the Second International Conference on Bituminous Coal held at the Carnegie Institute of Technology in November, 1928. The *Proceedings* are published in two volumes containing a total of 1,927 pages of type matter and illustrations. The text is composed of one hundred and eleven different manuscripts by some of the world's foremost fuel technologists, chemists and engineers, complete discussions by delegates, and a forty-page index. A majority of the papers are accompanied by illustrations. That the Carnegie Institute of Technology is already making preliminary plans for a third international coal conference is indicated in the foreword by Dr. Thomas S. Baker, president of the Carnegie Institute of Technology and organizer of the first and second conferences. "The success of the Carnegie Congresses and the developments in fuel technology which may be expected in the future encourage us to believe that another International Conference would be welcomed and would be of value." The second conference, according to the published proceedings, had a registration of about two thousand members, including delegates from twenty-two countries. The papers reproduced in the *Proceedings* cover low temperature distillation, origin, composition and classification of coal, use of pulverized fuel, fertilizers from coal, purification and cleaning of coal, power and combustion, liquefaction of coal, tar and oil from coal, gasification of coal and high temperature distillation.

THE report of the National Physical Laboratory which has recently been issued describes, according to a summary given by the London *Times*, researches in the various departments of the laboratory into physics, electricity, meteorology, engineering, aerodynamics, metallurgy and units of standards of measurement. Special attention is called by the report to the very full program of work relating to fundamental standards of measurement which has been completed, and to the increasing volume of experimental work in view under this head. Last year's report contained a reference to assistance given to the Council of Scientific and Industrial Research of the Commonwealth of Australia, in connection with steps being taken by them to establish on a satisfactory footing for use in Australia standards of measurement in agreement with those employed in Great Britain. In the early part of 1928 an offer was conveyed to the Commonwealth Research Council by the Lord President of the Privy Council, on behalf of his Majesty's

Government, to carry out without charge at the National Physical Laboratory the verification, over a period of five years, of the standards to be procured by the Commonwealth Research Council for use in Australia. Full information as to the standards likely to be required was sent to Australia in a report from the laboratory. Assistance has also been given to Canada, India and South Africa in connection with standards for specific purposes. The committee feels that it is of the utmost importance that help should be given, whenever possible, towards securing uniformity throughout the empire in the standards employed.

UNIVERSITY AND EDUCATIONAL NOTES

PRINCESS HENRY of Reuss has given $300,000 to the department of electrical engineering of Stevens Institute of Technology. Both the departmental and the professorship endowments will bear the name of Anson Wood Burchard, former husband of the princess, who, at the time of his death on January 22, 1927, was chairman of the executive committee of the General Electric Company and a trustee of the college.

BY the will of the late Mrs. Mary L. Walker Peters a bequest of $25,000 for research in cancer is left to Cornell University.

DR. FRANK CARNEY, professor of geology from 1904 to 1912 and professor of geology and geography from 1912 to 1917 at Denison University, has accepted the newly created professorship of geography at Baylor University. Since 1917 he has been chief geologist for an oil company. Dr. and Mrs. Carney will spend the summer in Europe with Professor George Grant MacCurdy, director of the American School of Prehistoric Research.

DR. PHILIP E. BROWNING, assistant professor of chemistry at Yale University, has been promoted to an associate professorship.

DR. H. R. ROSEN, since 1920 associate professor of plant pathology at the University of Arkansas, has been promoted to a professorship.

DR. H. A. BARTON, now fellow of the Bartol Research Foundation of the Franklin Institute, has been appointed assistant professor of physics at Cornell University.

PROFESSOR ERNST GELLHORN, of the University of Halle a/s, has been appointed associate professor of biophysics in the department of animal biology of the University of Oregon at Eugene.

DISCUSSION

A PIERRE DINOSAUR

A QUITE unusual find of petrified palm stems and a fragmentary dinosaur in association with the great marine turtles of the Pierre was briefly noted in the *American Journal of Science* for March, 1903 (p. 215), as follows:

> With *Archelon ischyros* and *Marshii*, there occur in the uppermost 100 feet of the Pierre as developed along the Cheyenne River a series of associated forms of uncommon interest. Firstly, I have obtained in this same horizon well-preserved toe bones of a Dinosaurian, nearly of the form, and nearly as large as those of *Claosaurus annectens*, which I shall (later) figure as *Claosaurus* (?) *affinis;* while presumably from the same drift from a not far-distant shore, I secured an exquisitely preserved new species of Palm stem, *Palmoxylon cheyennense.*
>
> Secondly, associated with these land forms occur Plesiosaurs, Mosasaurs, a shark (a broad-toothed Lamna), a fish allied to *Beryx*, and the following invertebrates—*Nautilus DeKayi* (very abundant in the matrix of one of the large turtle skeletons), the splendid *Placenticeras placenta, Scaphites nodosus, Emperoceras Beecheri* Hyatt, *Baculites ovatus* and *compressus* Say, *Callista Deweyi* M. & H., etc. (The determinations rest partly on the word in person of E. D. Cope and C. E. Beecher.).—Note:
>
> Such definitive associations of land and marine types are the actual milestones in the biologic course. Continuing the record, hence, Dr. N. E. Stevens later gave, following a previous paper on palm stems from the Upper Cretaceous of New Jersey, a finely illustrated account of the Pierre Palmoxylons. The stems are calcified, the thin sections show the finest detail and there may be several species. All the details are enhanced by my own observation during the past summer in the Mesaverde of the far west, of the frequency of palms in association with a splendid series of petrified cycadeoids. Ultimately the Mesaverde-Pierre point of equivalence must be determinable.

Not so fortunate the status of the accompanying *"Claosaurus* (?) *affinis,"* which threatens to fall into the discard as a *nomen nudum*. The specimen as held with season's collections had been compared directly with *Claosaurus*. There seemed to be no immediate need of illustration; no doubt the suggested name was one of convenience. Now, however, there is need of a further note as Dr. Hay is about to bring out his new bibliography of the fossil vertebrata of North America. My notes say that:

> On September 26–29, 1902, I walked from Buffalo Gap (northeasterly) twenty-five miles out to and along the Cheyenne. Several days' search along the Cheyenne and on "Squaw Humper Creek" resulted in little of interest. On the thirtieth, the fourth of the greater specimens of the giant turtle *Archelon* was located about one mile south of "Shoemaker Creek" on the west bank of the Cheyenne. It was while excavating this specimen that there was soon found not more than 300 feet away on the

top of a small Pierre knoll various much-eroded parts of a large skeleton, apparently Dinosaurian—the only distinct elements left being toe bones. Erosion of the knoll had been conditioned by the presence of the original fossil, but ten feet below the Oligocene overlap, and about fifty feet higher up than the *Archelon*. The type of the second species of the great turtles of the Cheyenne, *Archelon Marshii*, was collected from quite the same level as the dinosaur bones at a point about five miles northeasterly within the "badlands" East of the Cheyenne in 1898. Palm stem segments were found that year as well as in 1902, and came from both banks of the Cheyenne.

The Dinosaur toe bones as found on confrontation to correspond with II, I and IV, 1, 4 of the right hind foot of *Claosaurus*, are of course only casually referable to or comparable with that genus. One, of robust form, is in very good condition, the others only relatively so. The important fact is that such material occurs in the upper Pierre and must again be found. Certainly it is regrettable that such scattered but significant fossils are so seldom made the objects of early, utterly careful search. Twenty-seven years ago the Pierre of the valley of the Cheyenne was to the vertebrate collector still an all but untouched horizon. It had first attracted my attention in July-August, 1895, with results which are remembered. But always as such new and untouched regions are occupied, human curiosity, or rather unreason, cupidity and destructiveness of the untutored mind begins, and so many clues to the finest fossil types disappear. This is something that science should avert. The facts of the past, the lesson they teach are the necessitous heritage of all.

In the main, Dinosaurian occurrence in marine beds is a subject but scantly noted because the number of identified forms is being added to rather slowly. More than maps showing larger areas and too often introducing overlarge margins of vertical and horizontal error, short tracings of shore-lines, lacustrine and marine, for the times when the Dinosaur record appears to view, must help first in determining the absolute landscapes and their chronology. That the Dinosaurs of Como time lived in lagunal regions near the sea-level or arms of the sea, like those of the lower Amazon, and maybe in much colder estuarial plains like those of the Hoang Ho, is the usual statement. Curiously enough, certain of the armored Dinosaurs, presenting in their armor distinct analogies with the shells of turtles, are more or less marine in their occurrence, and may have been sea-haunting in habit. Such are the *Hierosaurus* (Wieland) of the Niobrara chalk, *Nodosaurus* as so well described by Lull from the Benton, and allied European types.

Of direct concern here is the Dinosaurian "from the chalk of the Smoky Hill River," called by Marsh in 1872 *Hadrosaurus agilis*. Later (1898), Williston said the occurrence might be in the Pierre, as the distinction between the Pierre and the Niobrara "was not known to Marsh." I have taken the trouble to examine the original type, which includes some fairly good but flattened toe bones of medium size, with appearance usual to Niobrara vertebrates and rather unlike those from the Pierre. This fossil has been bandied somewhat in the synonomy, but could be left where Marsh placed it under the genus *Hadrosaurus* (if merely queried). In the fifty-seven years subsequent to this first find, therefore, the Niobrara has yielded as its quota of described land forms the one additional Dinosaurian just noted and also one characteristic armor fragment from a silicified monocarpic cycadeoid; while in the Pierre occur the one Dinosaur and the Palms as renoted above, it being extremely likely that more such material has been seen without finding record.

In reality the Pierre is an outstanding horizon to the collector of vertebrates. There is no need to depend on or wait chance discovery. Especially along the valley of the Cheyenne, the upper Pierre, where much cut by cross currents of closing Pierre time, and where scored by a great Oligocene river channel, promises much to the patient collector and geologist.

G. R. WIELAND

YALE UNIVERSITY

ZYGOPHYLLUM FABAGO IN COLORADO

THE perennial plant, *Zygophyllum fabago* L., also known as Syrian bean-caper, has been reported by Pellett[1] to be naturalized over a considerable area near Mesilla Park, New Mexico, and to be useful there as a honey plant, but its presence in Colorado has not been recorded before. During an inspection of weeds in the San Luis valley of Colorado in August, 1926, attention was called to the presence of a perennial plant apparently new to the region and unknown to any one in the valley. It could be found in only one field southwest of Alamosa, Colorado. None of the specimens taken in 1926 were in flower at the time and were not identified. In July, 1928, County Agent Max C. Grandy sent to the Colorado Agricultural Experiment Station a quantity of this plant from the infestation visited in 1926. It was identified by Dr. S. F. Blake, of the U. S. Department of Agriculture, as *Zygophyllum fabago* L. There has as yet been no satisfactory explanation of how the plant was brought into Colorado.

Zygophyllum fabago is a native of the region extending from the steppes of Russia southeast to Afghanistan. It may be easily recognized by its suc-

[1] Frank C. Pellett, "A New Plant in the United States," SCIENCE, 63: 637. 1926.

culent, alternate, bifoliate leaves, with rounded leaflets 2 to 3 cm long; bright, salmon-colored flowers usually borne singly in the axils of the leaves; and green, five-angled, ribbed pods which vary from slender to rather stout, and from 3 to 8 cm in length. The stem, which sometimes grows to a height of five decimeters, is single at the collar with numerous branches above. The plant comes up each year from a tough, crooked, light brown perennial root that is about 1 cm in diameter. The root grows horizontally at a depth of from 10 to 15 cm below the surface, and sometimes extends several meters in the same direction, giving rise to shoots at irregular intervals. More than half of the cross-section area of the root is storage cortex.

In so far as is known, this field is the first and only place in Colorado where the Syrian bean-caper has become established. It has not been found to be troublesome in New Mexico and is even useful there. According to those who have watched this infestation of *Z. fabago* in Colorado, plowing alone has little effect upon it, alfalfa does not smother it out, and yet it does not seem to spread rapidly. The bean-caper has been controlled in this location by lifting the roots from plowed ground with a pitchfork, which exposes the roots and shoots to desiccation that eventually results in death. The roots apparently do not extend to any great depth in this one known infestation in Colorado where the soil is open and rather light. The enormous root system, however, looks dangerous, and gives reason to fear that if the plant becomes as abundant in heavier tilled soils as have Russian knapweed (*Centaurea picris*) and perennial peppergrass (*Lepidium draba*), it would be an equally persistent and noxious pest.

CHARLES F. ROGERS
COLORADO AGRICULTURAL COLLEGE,
FORT COLLINS

PROPOSED AMENDMENTS TO THE INTERNATIONAL RULES FOR BOTANICAL NOMENCLATURE

Article 36. Substitute for the present text the following:

Descriptions of new groups should be in a language generally understood by the scientific botanists of the world.

Note: Any person who has had sufficient botanical training and experience to qualify him to describe new genera and species of plants must be familiar with at least one of the more generally known languages.

Article 39—Recommendation XVIII ter.

In selecting the nomenclatorial type or standard species of the genera of non-vascular cryptogams to choose species that will fix the generic names as they are now commonly applied.

Example 1. Hypoxylon Fr. Summa Veg. Scand. 383–4. Fries first used the name for a genus to include 25 species now distributed in Ustulina, Anthostoma, Nummularia, Daldinia, Sordaria, etc. To take the first species, *H. ustulatum*, as type would displace the name Ustulina, and most of the other species which are now known as Hypoxylon would require another generic name. If, however, *H. coccineum*, species No. 11 in Fries' list, a well-known and widely distributed species, be taken as the type or standard species, the name Hypoxylon would be retained in its present general application and the nomenclature stabilized.

Example 2. The genus Valsa, Fr. Summa Veg. Scand. 410 contains 44 species representing several different genera. The first species *V. sorbi* is now known as Eutypella. By selecting *V. ceratophora* Tul. (*V. decorticans* Fr.) the name Valsa is retained in its present general application and many nomenclatorial changes are avoided.

Note: Numerous cases of this kind might be cited among the fungi. Following the above recommendation would largely obviate the need of a lengthy list of *nomina conservanda.*

A permanent nomenclatorial committee should be appointed to decide disputed questions regarding the choice of generic names and their types.

The writer will be pleased to receive notes of approval or otherwise from botanists.

C. L. SHEAR

WASHINGTON, D. C.

QUOTATIONS

THE CARNEGIE INSTITUTION OF WASHINGTON

ANDREW CARNEGIE was one of the first to appreciate the benefit that science could derive from being competently organized and directed. Although he never applied true research in his own mills and set up only testing laboratories, he knew what leadership had accomplished in his own enterprises. Laboratory research in pure science before his day had been conducted by gifted individual professors, and by 1900 they were complaining that they had become specialists who could not follow one another's work. What an enormous impetus science would receive if they could work together!

Thus was conceived the Carnegie Institution of Washington, which now celebrates its twenty-fifth anniversary. The six hundred volumes published by the institution, all devoted to research, testify to the clarity of Carnegie's vision and to the brilliant competence of Gilman, Woodward and Merriam as administrative presidents.

To summarize the institution's achievements would be to write the later history of science in twelve major departments. The colossal instruments of Mount Wilson have extended the visible heavens, so that we now regard the Milky Way as but one of many universes. Terrestrial magnetism, thanks to the cruises of the non-magnetic ship *Carnegie*, is now a recognized branch of geophysics, with a mass of facts so well correlated that the secular changes which occur in the mariner's compass can now be scientifically corrected. The institution's Cold Spring Harbor station has attacked the difficult task of determining how the thousands of different plants and animals originated and how they are still evolving, with results that would even now enable man to improve himself biologically and socially if he had the courage to apply them. In the Geophysical Laboratory discoveries have been made which enable us to form a truer picture of the process to which the earth was subjected when rocks and oceans were formed from a molten globe. Man's mechanism for converting food into tissue and energy is less mysterious than it was, thanks to the researches of Dr. Benedict and his associates. Mainly through the efforts of Carnegie archeologists have we been able to envisage the magnificence of the vanished Mayan civilization of Central America.

Mindful of its obligation to the public, the institution has placed its volumes in the principal libraries and has periodically issued simply worded statements which have been widely disseminated as news. Thus the great reading public and specialists have been welded to form a constituency for pure science. As it takes stock of its accomplishments the institution may pride itself on having faithfully carried out both the letter and the spirit of Andrew Carnegie's purpose, as expressed in the articles of incorporation approved by Congress, "to encourage, in the broadest and most liberal manner, investigation, research and discovery, and the application of knowledge to the improvement of mankind."—*The New York Times.*

SCIENTIFIC BOOKS

Die Pflanzenreste des mitteldeutschen Kupferschiefers und ihre Einschaltung ins Sediment. Eine palökologische Studie, by PROFESSOR DR. JOH. WEIGELT. 198 pp., 14 text figs. and 35 plates. Gebrüder Borntraeger. 1928.

THIS interesting and important contribution is an attempt to explain the manner of origin of the Kupferschiefer, largely from the evidence of the contained plant fossils—a subject that has been actively discussed, chiefly from other points of view, both by paleontologists and economic geologists, as is evinced by the bibliography of 171 titles. Much of this discussion has been concerned with the origin of the copper ores, a subject outside the scope of the present discussion, although Weigelt presents some evidence of the syngenetic origin of these ores.

The Kupferschiefer is a black bituminous shale, remarkable for its areal extent, which is said to be over 60,000 square miles, and for its slight but uniform thickness of between two and three feet. In places copper ores are abundant enough to have given rise to a mining industry, as along the flanks of the Harz. The Kupferschiefer lies on either a seven-foot conglomerate or on a white sandstone—the Weissliegendes, beneath which are several thousand feet of mostly barren red sandstones and shales of lower Permian age—the Rothliegendes. The latter includes coarse conglomerates as well as coals, and porphyritic and diabasic effusives and their associated tuffs.

Above the Kupferschiefer is a twenty-five-foot magnesian limestone with marine fossils, and this is overlain by thick saliferous beds of the upper Permian, with anhydrite, rock salt, carnallite, etc. Weigelt considers the area to have been land locked except on the east, with the Fennoscanian land mass on the north, the rising Armorican mountains on the west and the Variscan mountains on the south, the two last joining at almost right angles in the Auvergne, representing a period of folding frequently called the Hercynian, especially in France.

Weigelt derives the Rothliegendes from these rising mountains and considers them to have been sufficiently high to have brought about extremely arid conditions in the German basin, thus accepting the orthodox view that red sediments are indicative of deserts. The Kupferschiefer deposition was inaugurated by a transgression of the sea from the Russian region. This sea was very shallow and is considered to have been bordered during its transgression southwestward by a marginal zone of vegetation back of which was desert. The Weissliegendes, because it contains dreikanter, is interpreted as largely reworked dune sands and not a humic bleaching of basement sands. The plant fossils are believed to have been washed into the basin of deposition by occasional floods. Subsequent to Kupferschiefer time the connection with the open sea to the eastward was chocked, either by palustrine vegetation or a change in the attitude of the land, and its evaporation furnished the middle Zechstein salt deposits. This phase was followed by a renewal of sea connection and a second isolation resulted in the upper Zechstein salt deposits.

Most of the widely distributed plant débris consists of wood fragments or twigs, of prevailing coriaceous plants, profuse in individuals but sparse in species.

Much space is devoted to an analysis of their attitude and condition, as to degree of compression or maceration, the extent to which the twigs had lost their leaves or been otherwise dismembered. Over 130 pages are devoted to the plants, which are very thoroughly discussed and profusely illustrated, and the author's strictures on the multiplication of species by the older authors, especially Geinitz, are well deserved.

The plant material has come out of the mines almost entirely, and its impregnation with bitumen results in the rather rapid deterioration of features, thus rendering the older types almost worthless and necessitating the study of fresh material, of which Weigelt studied over 1,200 specimens and figures nearly 500. The chief plants comprise fragments of fern-like plants (probably seed ferns) among which Callipteris is predominant; pinnules of Taeniopteris —which may be a seed fern or a cycadophyte; Calamite branches and foliage (Asterocalamites); leaf fragments of Baiera; a new type named Archaeopodocarpus, which includes most of the earlier material called Ullmannia; various cones; Voltzia twigs, and considerable pollen.

The book is exceedingly thorough and the evidence is considered from a number of angles, so that it is very stimulating. It also eliminates from the literature of paleobotany many of the pseudospecies of older authors. Whether Weigelt's general picture of the history and ecology will stand, only time will tell. One wonders if the Hercynian folding may be confidently considered to indicate high mountain barriers; or if the Rothliegendes with its coal seams is necessarily a desert deposit because it is prevailingly red in color, although I suppose it is difficult for any one at Halle to think otherwise; also what became of the flood sediments that uprooted and swept the vegetation into the Kupferschiefer, and if the enormous amount of salts in the middle and upper Zechstein could have been furnished in the relatively simple way that Weigelt postulates.

Be this as it may, the book is a model of painstaking research in a relatively new and difficult phase of paleontology, and discusses a region of surpassing interest.

EDWARD W. BERRY
THE JOHNS HOPKINS UNIVERSITY

What is Life? By AUGUSTA GASKELL. Charles C. Thomas, Baltimore, Maryland. 1928. 324 pp.

THIS book challenges the attention by reason of the problem considered and the objective verifiable nature of the solution promised in the early chapters. The author endeavors to solve the immediate problem of abiogenesis and to account for all the characteristics of living forms, not only those thought of as physical but the so-called psychical qualities as well.

The essence of the theory is that at certain critical times the hydrogen atom has formed an unusual physical configuration. In this peculiar atomic condition organic chains are added in an intra-atomic union. These configurations, referred to as the Z systems, are the basis of life phenomena.

Gaskell does not hold to a strictly evolutionary scheme. She holds that the appearance geologically of newer and higher forms followed as a result of tremendous upheavals in the physical environment, which offered opportunity for new and more complex Z systems to arise. Evolution appears to be a genetic progression from lower to higher forms, the more complex Z systems, as an outcome of the law of probability, arising more infrequently than the simpler systems and later.

A point of interest to the psychologist is the dualistic system suggested by the theory. The Z system has definite material properties analogous to those of the ordinary physicochemical system. In addition it has the attributes of the unique Z configuration which are the life properties.

Intelligence is determined by the complexity of the Z system, whose maturation is inversely proportional to its complexity. Gaskell holds that, as a result, the length of the period of infancy must be accepted as a standard of measurement for rating the intelligence of a race or people.

Among the miscellaneous problems theoretically solved by Gaskell is the cause of cancer. Injury to certain cells of the body results in the formation of indifferent cell material in which a critical concentration of ions develops, affording the opportunity for the growth of a neoplasm. The inference is that the conditions following the trauma determine a local independent Z system.

In considering the value of the theory it must be pointed out that Karl Compton, in the Introduction, speaking from the physicist's point of view, states that we know nothing about the assumed Z combination of protons and electrons, and consequently we may consider such a theory possible. It is evident that Gaskell's theory lies wholly within the conjectural realm. The method of unique assumptions affords the possibility of building any number of logical systems in the explanation of any phenomena. The biogen molecule is an attempt to explain vital phenomena in terms of a unique physicochemical situation. A number of other examples of similar attempts in the history of science could be cited.

Notwithstanding a chapter devoted by the author to the possibilities of experimental verification of her theory, we find no evidence that such verification is

possible. Mrs. Gaskell's book can hardly be considered a contribution to the problem of abiogenesis and the nature of life, however interesting it may be as a speculative essay.

H. F. ISRAEL,
L. P. HERRINGTON
STANFORD UNIVERSITY

SPECIAL ARTICLES

A POSSIBLE METHOD OF ENHANCING THE THERAPEUTIC ACTION OF ANTI-BACTERIAL SERUMS

THE therapeutic effect of antibacterial serums designed to act directly upon bacteria, as contrasted with antitoxic serums which act on their soluble toxins, has been notoriously disappointing. This seems surprising in view of the demonstration in such antiserums of antagonistic substances which are known to combine with bacteria and lead directly or indirectly to their destruction in the test-tube and even in the animal body. It is our opinion that only one antibacterial serum, namely that directed against the meningococcus, can be regarded as having approached expectation. For many years efforts have been made to increase the effect of such antibacterial serums by intensifying their content in antibodies or by attempting to conserve original antigenic complexes in the bacteria used for immunization. We believe that we may now be in a position to explain the reason for the inadequacy of antibacterial serums in general and to hint at possibilities for its remedy.

In a series of articles for the past ten years, we have been interested in emphasizing the importance of fixed and mobile tissue cells of the mononuclear series (clasmatocytes, polyblasts or histiocytes), particularly as they exist in granulation tissue, in enhancing the natural resistance of animals to localized infections. It has been found that non-specific mobilization of these clasmatocytes causes an area in which they have been accumulated to be markedly resistant to an otherwise extremely pathogenic strain of streptococcus. Moreover, it has been shown[1] that these cells, once accumulated, are, within certain limits, mobile from one part of the body to another in response to a localized infection. For example, the transfer of an irritated omentum containing large numbers of these cells from one animal into the peritoneum of another will, to a moderate degree, lead to increased resistance in the recipient's pleura. It is possible, even, to use the omentum of another animal species, like the guinea-pig, in the rabbit.

Our own experience, as well as the results of others, have brought the realization that this simple accumulation of clasmatocytes, although markedly successful against streptococcus and staphylococcus, does not protect against other micro-organisms such as the *Treponema pallidum*, the Pasteurella group[2] and particularly the pneumococcus. The hitherto unpublished studies of one of us (A.R.C.) with the pneumococcus have thrown an extremely interesting light on this apparent ineffectiveness of clasmatocytes. The prepared pleural cavity of the rabbit, which protects the animal so well against the streptococcus, has not, alone, the slightest effect in protection against the pneumococcus, although the strain of this latter organism employed was apparently of the same grade of pathogenicity as the streptococcus against which marked protection was assured. Washing the pneumococcus led to no greater protection. When, however, the pneumococcus was treated with a small amount of antiserum, a very marked protection resulted. The same sensitized pneumococci in the doses used were rapidly fatal for unprepared rabbits and for rabbits whose pleural cavity exhibited an acute inflammatory exudate. (Polymorphonuclear.)

These results are one step beyond those obtained by Singer and Adler[3] and Tudoranu,[4] who have come to the conclusion that active immunity in animals against both pneumococcus Type I and pneumococcus Type III infections is due to a cooperation of mononuclear cells and the antiserum, the first factor being the more significant one. This explanation is paralleled by a similar explanation of active acquired immunity to the streptococcus suggested by Bass[5] and Kanai.[6] The brilliant experiments of Stuppy, Cannon and Falk[7] still further emphasize the characteristics of active anti-pneumococcus immunity. These authors have recently found that when rabbits are locally immunized against pneumococcus through the respiratory tract a reinfection by this route is harmless, and is accompanied by a massing of mononuclear cells in the alveoli.

Our own experiments, then, have demonstrated that pneumococci differ from streptococci in regard to protective mechanisms in that the former require for disposal not only an adequate number of mononuclear cells, but tropinization by immune serum. The importance of the mononuclear cells, however, remains equally significant in both instances. We have further been able to show that, although two hundred lethal

[1] Gay, Clark and Linton, *Arch. Path.*, 1: 857, 1926; Linton, *Arch. Path.*, 6: 615, 1928.

[2] Halley, Chesney and Dresel, *Bull.*, Johns Hopkins Hospital, 41: 191, 1927.

[3] *Zeit. für Immunitats.*, 41: 418, 468, 1924.

[4] *Annal. Pasteur*, 40: 606, 1926.

[5] *Zeit. für Immunitats.*, 42: 261, 1925.

[6] *Verhand. der Japan. Path. Gesell.*, 9: 126, 1919.

[7] *Proc. Soc. Exp. Biol. and Med.*, 36: 314, 1928.

doses of streptococci are ineffective in the presence of sufficient numbers of mononuclear cells alone, this resistance is still further enhanced to protection against some ten thousand doses if the streptococci are previously treated with immune serum. Such sensitization of the bacteria, however, does not suffice to afford protection in any degree to the normal animal or even when much larger amounts of immune serum are used.

Our suggestion, then, is that antibacterial serums fail to cure not through the absence of suitable or adequate amounts of antagonistic substances (tropins) but through the absence in the recipient of sufficient numbers of mononuclear cells necessary to accomplish the destruction of the tropinized bacteria. There is further evidence, which can not be recapitulated at this time, that the actively immunized animal varies from the normal animal in the rapidity with which mononuclear cells are mobilized at the point of inoculation, as is indicated by the work of Stuppy, Cannon and Falk, by certain types of local immune reactions and by the study of the conditions of local immunity. Furthermore, in spite of the fact that in the extensive studies of phagocytosis by polymorphonuclears it has been generally accepted that these cells do not differ in the immune animal from their originals in the normal animal, we believe that a study of the qualitative reactivity of the macrophages in the immune animal is indicated. It may well be that not only are mononuclear cells in sufficient number necessary, but that mononuclear cells of an actively immune animal are required to insure passive immunity. Either variety of cells could certainly be supplied from homologous or possibly heterologous animals, and the hypothesis here stated is at least capable of experimental study, whatever the practical outcome in serum therapy may be. Experiments along this line are actively in course.

FREDERICK P. GAY
ADA R. CLARK
COLLEGE OF PHYSICIANS AND SURGEONS,
COLUMBIA UNIVERSITY

THE COMPOSITION OF PECULIAR CLINKERS FOUND IN SNAGS AFTER FOREST FIRES

CONSIDERABLE interest is being shown by the personnel of the U. S. Forest Service over the occasional finding of peculiar rock-like clinkers in hollow snags which are sometimes left after a forest has been burned over. These clinkers usually have a greenish tint and by some people are thought to be of meteoric origin and responsible for the starting of certain forest fires. While this theory of their origin seemed improbable there was still a general feeling that the presence of the clinker material might be associated with hold-over fires, and a definite knowledge of their composition was desired. The matter was referred to us by Dr. Raymond Kienholz, of the department of botany at the University of Illinois, and all samples analyzed by us were collected by him while he was engaged in forest research work in the northwest. A fuller account of the finding of these clinkers with respect to geographic distribution, forest species and fungal action will be reported later by Dr. Kienholz in the *Journal of Forestry*.

Samples I and II were found on the Kaniksu National Forest near Priest Lake in northern Idaho. Sample III was from the Wind River country of southern Washington, as was also the sample of sound wood. All were taken from the western hemlock (*Tsuga heterophylla*).

The results of the analyses are given in the following table.

CHEMICAL COMPOSITION OF THE CLINKERS AND ASH OF SOUND WOOD

Constituent	Percentage of constituent			
	Clinker I	Clinker II	Clinker III	Sound wood
Crude SiO_2	.32	.38	.41	.....
P_2O_5	6.96	6.58	5.47	.0227
R_2O_3 (Fe_2O_3) (Al_2O_3)	1.68	.99	.34	.0096
SO_3	Trace	Trace	.67	.....
Cl	Trace	Trace	Trace	.....
CaO	22.02	21.90	21.79	.0424
MgO	6.28	4.48	4.06	.0226
Mn_3O_4	1.21	1.32	7.17	.0252
K_2O	25.01	24.54	30.42	.0750
Na_2O	5.31	2.06	4.20	.0173
CO_2	19.76	25.47	.....	.....
Total	88.35	87.72	74.47	.2148
Difference (including H_2O, carbon, etc.)	11.65	12.28	25.53 (incl. CO_2)	

An examination of the table shows that the clinkers are all of quite similar composition. This is especially true of the two from the same locality. Very little data on the complete analysis of ash of American woods is available for the comparison of composition, but rather wide variation would be expected. The species, section of the tree from which the wood was taken, locality in which the tree was grown, and other factors would have a marked influence. If the ratio of each other constituent to K_2O be calculated for clinker III and the ash of the sound wood from the same locality a very close analogy of composition will be observed.

There is no justification for the assumption that the clinkers are of meteoric origin.

Their greenish tint is due to manganese in the manganate state. Although the manganese content of Sample III is much greater than that of either of the other samples, it is not unusual. Various investigators[1] report quantities of Mn_3O_4 which range from less than 1 per cent. to over 40 per cent. of the pure ash of the wood.

The peculiar rock-like character of the clinkers is probably due to the collection of a large quantity of the ash in the hollow snag, followed by occasional wetting from rain and finally a fusion of the mass during a later vigorous burning of the surrounding wood. It is doubtful if any chemical action due to the clinker would be capable of causing ignition of a snag and a rekindling of a fire. The formation of the clinkers is probably incidental to hold-over fires.

DUANE T. ENGLIS
W. N. DAY

CHEMICAL LABORATORY,
UNIVERSITY OF ILLINOIS

THE EFFECT OF X-RAYS ON POTATO TUBERS FOR "SEED"[1]

IN view of the recent article by Johnson[2] on increased tuberization of potatoes caused by X-rays, it may be worth while to report results of a similar experiment in which the findings were contrary to those indicated above. Certified "seed" of both Irish Cobbler and Green Mountain varieties was used, and two dosages of X-rays were employed.

One half of each tuber was irradiated and the other half was left untreated as a control. One lot of half tubers was irradiated for ten minutes and a second lot for five minutes, using a Waite and Bartlett machine, 200 K.V., 4 M.A., distance 50 cm, field 20 x 20, filter 1 mm al., *i.e.*, in human, erythema dosage 10-min. = 2 E.D., 5-min. = 1 E.D. The tubers were placed with the cut side down and sprouts up when irradiated. Sprouts were just beginning to develop at the time of exposure and the tubers were planted in the field on the following day. Each "seed" piece was cut to a weight of thirty grams using the "bud" end, and the pieces were spaced nine inches in the row. The corresponding treated and untreated pieces were planted in adjoining rows thirty-two inches apart. The soil used was Sassafras sandy loam of good fertility, and a 5–8–7 fertilizer was used at the rate of 1,000 pounds per acre. Ordinary tillage was practiced and the plants were dusted periodically with lead arsenate to control the potato beetle. The crop was harvested by hills after the vines were dead, and each tuber was weighed separately.

Plants from the lot of tubers receiving the ten-minute exposure produced only 84.4 per cent. as many tubers of all sizes as the untreated controls, and only 89.6 per cent. as many tubers weighing over forty-five grams each. Although the total weight of all tubers was reduced 6.0 per cent. by the treatment, the total weight of tubers weighing over forty-five grams each was increased 6.1 per cent. The average weight per tuber of marketable stock (over forty-five grams per tuber) was 81.6 grams for the lot irradiated ten minutes, as compared with 68.9 grams for the untreated lot.

Plants from the lot of tubers irradiated five minutes produced 104.7 per cent. as many tubers of all sizes as the controls; and 105.1 per cent. as many tubers weighing over forty-five grams each. The total weight of all tubers was increased 3.0 per cent. by the treatment, and the total weight of marketable tubers was increased 3.8 per cent. The average weight per tuber of marketable stock was 74.7 grams for the lot treated five minutes, as compared with 73.7 grams for the corresponding untreated lot.

The ten-minute irradiation caused the first leaves of the plants to assume a peculiar shape. The leaf tips appeared to have been injured and the blade was pinched-in as it approached these lesions. The margins of the leaf curled downward, and the leaf in general seemed to be somewhat more glossy than normal leaves. Subsequent leaves of these plants were normal. After formation of normal leaves the plants were vigorous, and remained green several days later than untreated plants at time of maturity. No striking abnormalities resulting from irradiation were noted in the harvested tubers. Irradiation for five minutes produced no apparent modification of plants or tubers.

These results indicate that strong dosages which cause definite lesions on leaves may also reduce the number of tubers formed; but such tubers may attain a greater size, so that yields of marketable stock are not lowered. It seems likely that still stronger dosages may reduce tuberization still further, and perhaps the yield of marketable stock as well. Further experiments of this nature are being planned.

HOWARD B. SPRAGUE

COLLEGE OF AGRICULTURE
RUTGERS UNIVERSITY

MAURICE LENZ

MONTEFIORE HOSPITAL
RADIUM CLINIC
NEW YORK CITY

[1] Czapek, "Biochemie der Pflanzen," II, 411, 1920.

[1] Journal Series paper of the New Jersey Agricultural Experiment Station, department of agronomy.

[2] E. L. Johnson, "Tuberization of Potatoes Increased by X-rays," SCIENCE, 68: 231, 1928.